SIGHT AND SIGNALLING IN THE NAVY.

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(*Read April 13, 1916.*)

Perhaps a better title for my paper would have been "Desultory Notes of an Ophthalmologic Signalman." Such a title, moreover, would indicate the paper's only excuse for being. For desultory as the notes unfortunately are, the author has felt that they might be of some service because, being both an ophthalmologist and a signalman, he had a somewhat unusual advantage in studying the subject. As an ophthalmologist, he had been concerned with the observation of visual phenomena and knew something of the physical and psychic factors underlying them; while as a signalman, quartermaster, and signal officer in the naval militia and navy, he acquired a practical acquaintance with the various forms of naval signalling under service conditions.

In considering the subject it is important to have some idea of what constitutes naval signals and to know in general how they are made and interpreted.

For the purpose of this paper, signalling may be defined as the art of communicating with another person by means of symbols other than written or spoken words; such symbols consisting, according to the method employed, of shapes, lights, sounds, movements, or any sort of exhibit whatever that can be appreciated at a distance. These symbols, either singly or combined in groups, are use, according to some special system, to denote individual letters, digits, or other characters; and these characters in turn are combined according to some preconcerted code to form messages.

The special symbols employed in any one system are called the elements of that system; and the system is said to have 2, 3, or 10 elements, according to the number of different kinds of symbols used in it to form the letters or characters. Thus a signal consisting of a display of lights vertically over one another at a ship's mast is said to be made by the Ardois Method. It is made with two elements, since only two kinds of symbols (viz., red and white lights)

are employed. These elements are combined according to the International Morse System to form letters; and a succession of such letters may form an arbitrary combination to be interpreted by the Navy Code.

Methods of Signalling.

The methods used in navy signalling are as follows:

(*a*) *Motions.*

Wig-wag (movement of flag, torch, search-light, or other object from side to side).

(*b*) *Flashes of Light.*

Flash lantern and winker light.

(*c*) *Colors, Fixed or Moving.*

Display of colored and white lights (usually several in one display) (Ardois Method).

Projection into the air of rockets or red and green stars (Very Method).

Coston and other lights.

(*d*) *Forms.*

Cone, top, and drum.

Square flag, pennant, and ball.

Semaphore.

(*e*) *Forms and Colors.*

Hoists of colored flags.

(*f*) *Sounds.*

Steam whistle, bell, gunfire.

Telegraph (usually wireless).

Systems of Signalling.

The systems commonly used in naval signalling are these:

Dot-Dash System.—Comprises two or usually three elements,[1] viz., right, left, and front motions (Wig-wag); short, long, and extra long flashes (Winker Light, Heliograph); red and white lights (Ardois); red and green stars and rocket (Very Method); short, long, and extra long (or single, double, and triple) sounds (Sound

[1] Really in these systems there is a time interval (between letters) which constitutes a fourth element.

Signals). Two of the elements are combined to form letters according to the International Morse Code, and if there is a third, this is used to form an interval or make some special signal.

Semaphore System.—Comprises 8 elements, viz., the eight positions of each of the two arms of the semaphore (or the two arms of a man). Combinations of these according to a special code form the various letters of the alphabet and special signals.

International Hoist.—Comprises 27 elements (flags denoting 26 letters of the alphabet and one answering or code pennant).

Navy Hoist.—Comprises 45 elements, viz., the 26 alphabetic flags of the International System and 19 others (repeaters, guide, recall, position, etc.)

International Distance System.—Comprises 4 elements, viz. cone, top (inverted cone), drum, ball. (A square flag may be used for cone, pennant for top, a pennant tied back to halliards or a flag tied in the middle for a drum.) These combined according to a special system form letters and special signals.

Navy Distance System.—Comprises 3 elements, viz., cone, top, and drum. These combined according to a special system form letters and special signals interpreted by the Navy Code.

Signal Codes.

Signal codes are divided into two great classes, Alphabetic and Signal-Book Codes. In an *Alphabetic Code* the letters or digits indicated by the special system employed have their actual value as letters or digits, and are further combined to form words and numbers just as they are in ordinary writing—to form, in other words, what we may call spelling messages. In a *Signal-Book Code,* the letters indicated by combining the elements in the system used are mere indexes referring to special messages or words contained in a code-book. Thus the elements 1, 2, 3, of the dot-dash system, when used in its ordinary way as an alphabetic code, would if combined thus, 22 2122 3, denote the actual letters M Y, spelling the word MY. But the same letters whether sent by the Dot-Dash System, the International Flag System, or the International Distance System would, if interpreted by the International Code, have no mean-

ing as letters, but would denote the message "Ship disabled; will you tow me?"

The following codes are used:

Alphabetic Codes.—Unless notice by special signal is given to the contrary, all messages sent by wig-wag, Ardois, telegraph, winker light, and semaphore are spelling messages. All of these are interpreted by the International Morse Code except the semaphore, and this is read by the semaphore code. In certain cases the flags of the International System may also have their alphabetic meaning and be used to form spelling messages.

Signal-Book Codes.—All messages sent by flag hoist, shapes, steam-whistle, and Very stars, and occasionally[2] messages sent by other methods are code messages, to be interpreted by special signal codes. These signal codes are the—

International Code used with the International Flag Hoist. It includes the slightly variant code used with shapes for sending International Distance Signals.

Navy Code used with flag hoist, shapes, steam whistle, and Very stars. The regular Navy Code includes battle signals, general signals, boat and deck signals, and speed signals. To these may be added the towing, running, and riding lights (International), buoy and lighthouse signals (U. S.), storm signals, and the various officers' and national flags.

Of course a message, whether a spelling or code message, may be transformed by cipher, previously agreed upon or denoted by the signal sent.

What a Signalman Has to Do.

The signalman must have an intimate working knowledge of eight different methods of signalling (by wig-wag, light flash, Ardois, Very stars, sounds, shapes, semaphore, and flag hoist) to be used according to six different systems. He must know with absolute certainty the signification (often multiple in each case) of some 30 combinations of right and left movements, 30 combinations of red and white lights displayed over one another, 30 combinations of red and green stars projected into the air, 30 combinations of short and long flashes or of short and long sounds, 30 different positions

[2] When preceded by the special call meaning "signals follow."

of the semaphore, and some 50 different flags, not to speak of the various national flags. In addition, he must know the various day and night position and speed signals, danger signals, truck light, side lights, and weather signals, the different kinds of buoys and beacon lights, and must be able and ready to pick up boats, ships, and rocks. He is the "eyes of the ship" and on his vigilance and sight, speed and accuracy, the ship's safety may largely depend.

The signalman's duties then are both highly important and also are varied and complex. They demand a considerable degree of intelligence and skill. In this as in all other skilled work, experience and practice count enormously. To an outsider it is amazing to see the facility with which an experienced man can fulfill all these duties and carry them on for a long time without apparent mental and physical fatigue. One signalman, who did not claim to be specially proficient, told me that he once read visual signals without intermission for two hours and a half, and when his work was done felt no more tired than if he had been reading a book for the same length of time. Yet during this long period eyes and mind must have been intent with scarcely a moment's respite on ever-varying combinations of symbols. And the quickness with which signals are appreciated and the necessary responses given is equally astonishing. For example, when in squadron evolutions a flagship is setting flag signals, the flags, bent on to the halliards, do not, of course, break out so as to be visible until they are started on their way up. Yet it is no uncommon thing for every ship in the squadron to send its answering pennant up before the flagship's display has reached the top, thus showing that in two or three seconds at the most the four or five flags comprising the signal have been read, understood, and answered by every signalman—and that even when some of the ships are several miles away.

Such expertness, of course, comes only with practice. The beginner not only discerns signals less readily, less far, and particularly with less certainty than the expert, but he tires soon, so that his work quickly becomes unreliable.[3] Now even in time of peace,

[3] Recognizing this, a quartermaster will not keep an inexperienced signalman looking too long, especially through a field-glass, at a semaphore or winker light, but will relieve him after a few sentences have been taken. So

but, of course, much more in time of war, the exigencies of the service may be such that the skilled man is not available. He may have to be replaced by a man not sufficiently trained. This is particularly the case under present-day conditions when our warships are deplorably undermanned. It is important, therefore, to consider what difficulties an inexperienced man has to contend with and how these difficulties affect his reading of signals.

There is another aspect of the matter. There are some men who never become good signalmen. The practice has been to discover whether this is so or not by selecting a man haphazard, trying him out, and rejecting him if he fails. It would be better surely to be able to form some idea in advance of what the causes of disqualification are, so that the right sort of man might be picked out in the first instance and no time wasted in training the inefficient.

From both points of view it becomes us to consider the factors that determine a man's ability to perform signal duty. These factors are: (1) The character of the signals themselves and the way this character is affected by external conditions. (2) The signalman's own physical and mental qualifications.

Intrinsic Character of Signals Themselves.

Signals differ very greatly in:

1. *Visibility.*—Some even under the best conditions can hardly be seen beyond two or three miles (by the tyro not so far), others can be seen any distance.

2. *Legibility.*—Some signals, especially those having a large number of elements (flag signals) or in which the elements are shown in groups (Ardois) or very rapid succession (semaphore, hand wig-wag), can usually be seen further than they can be read—although it must be stated that this discrepancy between legibility and visibility is most marked with beginners and diminishes rapidly as experience grows. Other signals (winker light, wig-wag by flashlight or searchlight, Very stars) can be read even by beginners as far as they are seen.

3. *Amount of Strain They Impose on the Sight and Attention.*—

also a signalman, when finding himself getting unsteady, will ask a companion by him to take his place.

This is particularly great with the semaphore and especially the winker light.

External Conditions Affecting Signals.

These are:

1. Faulty Technique in Sending.—Mistakes may occur with any method; but faulty technique gives trouble particularly with the hand wig-wag, hand semaphore, and winker light. It affects visibility scarcely at all, but often greatly reduces the legibility of messages. By impairing legibility it puts an added strain on the sight and attention of the observer.

Faulty technique includes not only carelessness in the mechanical execution of the signal, but also failure to acknowledge signals properly, failure to secure a proper background when requested, failure to correct errors, and too slow sending. Such faults, if persisted in, unduly prolong the message and weary the receiver.

2. Weather Conditions.—These naturally affect both visibility and legibility, especially the latter. Flag hoists and Ardois become particularly difficult to read in thick weather and may have to be replaced by distance signals or even by sound signals. Flag signals, if the ship is not under way, require some breeze for their proper display; but a gusty wind may interfere a good deal with their legibility.[4] The sun, if behind the observer, is usually a help especially in hand wig-wag, hand semaphore, and flag displays. The light shining on the display and reflected from it, makes the signal stand out better, especially when the latter is in motion or shows contrasting colors (hand wig-wag, hand semaphore, flag signals). Per contra, the sun behind signals not only tends to drown them out so that they are hard to read, but also causes so much irritation and dazzling as the result of glare, that the eyes may soon tire and become unserviceable.

A strong wind blowing in the observer's face may make the eyes water and so interfere with the reading of signals.

3. Use of Field Glass.—Some signalmen prefer to use the naked eye, but many habitually use either a spy-glass or generally a low-power field glass. This about doubles the distance at which signals can be read and increases the legibility of some signals, espe-

[4] For the tyro at least. The older and more experienced man will find little trouble on this score.

cially the night semaphore. When, however, the ship is rolling or pitching a good deal, it is difficult to keep the glass on the object. It then becomes quite hard to read the signals, and the strain on the attention is considerably increased. And even when there is no motion the use of a glass causes more strain than looking with the naked eye.

4. *The Motion or Position of the Ship.*—This not only makes the use of a glass difficult, but even with the naked eye interferes with the observation of signals. So too, the ship may be so placed that flag or semaphore signals are not easily seen or have a poor background.

5. *Occlusion of Object* by spars or funnels or by the sudden dipping of the ship in a heavy swell.

Influence of These Conditions in Special Cases.

The visibility and legibility of the chief methods of signalling and the demands they make upon the eyesight may be summarized as follows:

1. *Hand Wig-Wag.*—The regular wig-wag signal kit comprises two-foot, four-foot, and six-foot flags, white, red and black. The black flag is supposed to be used with a sky background, but is rarely employed. The red flag theoretically would show better than the white against a green or white background, but, as a matter of fact, the white shows best under almost all circumstances.

The wig-wag is visible a very considerable distance. Its legibility varies very greatly with the technique of the sender and with the background. Given a good sender and a good sky background, the wig-wag messages with the large flags can be read over six miles[5] even with the naked eye. This method requires close attention, but is not particularly tiring to the eyes.

Very legible is the night wig-wag with oil or electric lantern.

2. *Wig-Wag by Searchlight.*—A searchlight projected against a cloud and waved from side to side like the hand wig-wag, can be seen and read practically any distance. Vessels have signalled in this way from ocean to ocean across the Isthmus of Panama—the

[5] The statements in this and the following paragraphs regarding range of visibility are to be taken as the maximum for expert receivers. For ordinary signalmen, particularly when the weather conditions are not good, these distances would be halved.

ships being forty miles apart. The messages are very legible and the method not taxing to the eyes.

3. Hand Semaphore.—This has largely replaced wig-wag, because the signals can be made faster. I am a tyro at it myself, and for that reason, perhap, it seems to me more difficult and less legible than the wig-wag. It certainly requires careful technique, otherwise certain combinations are indistinguishable from each other (*e. g.,* O from I and W from X). It is said that a good observer can read signals three or four miles, but this depends greatly on the sender and the background.

4. Machine Semaphore.—By day the semaphore arms are readily seen if the background is good. By night the lights on the two arms are apt to blend in the acute angled signals (H, O, T, W, Z), making it somewhat difficult to determine whether one or two arms show. This difficulty does not obtain when a field-glass is used. If the night semaphore is worked rapidly, the after-images produced by one display might theoretically be confused with the display following, but this seems not to occur. The shifting lights are somewhat trying to the eyes of the inexperienced. The range of legibility is variously stated at one to three miles or more.

5. Winker-Light.—This, like the heliograph which it greatly resembles, can be seen practically any distance, provided the sender or receiver is sufficiently elevated above sea-level and intervening obstructions. If the technique of sending is good, the light-flash can be read as far as it can be seen. In India, where sending can be done from great elevations, the heliograph, they say, can be read a hundred miles. I have signaled with it sixteen miles. It might be used that far on shipboard. To do so would require both observer and sender to be rather more than forty feet above sea-level.

The winker light is quite trying to the eyes, especially when received through a glass, and beginners cannot receive long at a time without their attention flagging and their work being unreliable. Twinkles and flashes[6] impinging in rapid succession on a partially dark-adapted eye, cause considerable strain, although it is a strain to which one does get remarkably accustomed.

Just as the searchlight is used for wig-wag it is also used for

[6] Readers of Kipling will recall his graphic lines:

"A heliograph *tempestuously* at play."

throwing dots and dashes of light against a cloud. Such signals, which are the same as winker-light signals, can be seen and read practically any distance.

6. Ardois Signals.—The Ardois is not as fast as the semaphore, but faster than the winker light or wig-wag. The signals are easily seen and easily read. Observers differ a good deal as to the range of visibility of the Ardois—some alleging that it can not be read more than three miles under the most favorable conditions, others that it can be seen from four to six miles. This is with the electric lamps on shipboard which are slung twelve feet apart. In some experiments that we made at our Fire Island signal station during the Spanish-American War, similar lamps lighted by acetylene were read eight miles.

At long distances the several lights of the display run together into a continuous bar, but even then it is possible to read the signals by noting whether the bar is long or short and whether it is plain red or plain white, or white beaded with red. The red light naturally looks smaller and dimmer than the white, and it would doubtless be an advantage if the red lamp were made larger and of more candle-power so as to equalize the visibility of the two.

The Ardois displays may be obscured by funnels, masts or other interventions; and it sometimes happens that in the complex of wires that go from the keyboard to the lamps some part will give out, so than one or more of the thirty combinations is defectively given.

The Ardois makes very little tax on the eyes.

7. Flag Displays.—Flags of battleship size can be read six miles or more by a practiced observer. This, however, obviously depends on many factors—the clearness of the atmosphere, the direction of the sun,[7] the way the flags blow out in the wind,[8] the character of the background, etc. The colors used are white, red, blue, yellow, and black (the last in only three of the flags). White is by far the most conspicuous color, and in the party-colored flags may be the only part visible. Some, in misty days or at dusk, find difficulty in discriminating between certain flags like L and U but the experts say they never have trouble on this score.

[7] Sun behind flags interferes very seriously with the ability to read them.

[8] A little flapping enhances the legibility of the flag; a good deal of flapping impairs the legibility.

Flag signals, being necessarily intermittent, make no great demands on the eyesight.

Factors in the Signalman Himself.

The factors that may affect a signalman's[9] efficiency are:

1. Faulty vision.
2. Defective color vision.
3. Refractive errors, including defective accommodation.
4. Muscular errors.
5. Slow reaction time.
6. Slow adaptation.
7. Effect of after-images.
8. Fatigue from prolonged, excessive strain of eyes and body.

1. Faulty Vision.—Fortunately in our navy, owing to the insistence of the medical officers, the visual requirements are high, so that seamen generally, and hence the signalmen also, must have good vision in each eye without the aid of glasses.[10] It is very important that this standard be maintained. I may add that it is a great pity that the same standard has not been maintained in the army. In the conditions of naval service and of army service too, acute vision is important, and glasses are a considerable handicap. Readily fogged by moisture, smoke, or grease, they may obscure the vision just when it is most needed. For in quick signalling, when a second or two lost may mean the loss of a message and the consequent delay of a whole squadron in some important evolution, one has not time to clean glasses or replace them when broken. And if one pulls the glasses off and goes on without them, the sudden change in visual acuity and the sudden strain on the accommodation thereby produced may, even with no very great refractive error, reduce the sight below service requirements. I myself had a good example of this during a week's cruise on the San Francisco in 1896. Without glasses I had a vision of some $\frac{20}{30}$ to $\frac{20}{40}$. Soon after the cruise started my glasses were broken. When it came my turn to act as gun-pointer, I could not see the target; when I took my place

[9] What is said here about signalmen applies in general to gun-pointers and others doing similar work making special demands on the eyesight.

[10] The requirements are $\frac{20}{20}$ in each eye and for gun-pointers $\frac{20}{15}$ in the eye used for sighting.

as lookout, I had a half hour of concentrated misery, since I was absolutely uncertain whether the dancing spots on the horizon were lights to be reported or mere ignes fatui. Certainly I was not qualified to be "the eyes of the ship" that night.

2. Defective Color Vision.—Obviously a signalman must be free from even slight defects of color perception. It is his business to deal with colors (red, white, and green lights, and various colored flags) seen often in the most unfavorable atmospheric conditions. It is fortunate that our navy like all others recognizes the imperative necessity that every man in it should be free from color defects. It clings, to be sure, to the outworn Holmgren test with wools, when experience has shown that it would be better to use the equally simple and more certain tests of Nagel and of Stilling, as well as the very practical lantern tests. Still our medical officers are very keen in this regard, and it is very rarely the case that any man with color defects slips by them. Moreover, in signal training, the presence of any serious defect would soon show itself by some failure in reading Ardois signals and especially in making out certain flags at signal distance.

3. Refractive Errors.—Moderate uncorrected refractive errors—hyperopia and astigmatism of a dioptry or so—are quite compatible with keen sight. Eyes affected with them, however, may give out under prolonged strain either of the eyes themselves or the whole body. This has been seen in the European war, in which, as noted by two English observers, men with only a minimum amount of hyperopia suffer such deterioration of sight from the prolonged strain and fatigue of trench fighting that they become useless as marksmen. In view of the very exacting demands made on a naval signalman, and in view of the fact that in our short-handed navy the hours of work of any one man may be inordinately prolonged, it would seem important that men with even slight errors of refraction should be carefully tested under exacting service conditions, and if they show tendency to give out under the strain, should be kept on probation until it is definitely determined whether they are fit for the work or not.

4. Defects of the Eye Muscles.—No man with an obvious squint would be allowed to enter the navy, but many a man may get in with a comparatively large latent deviation caused by muscular im-

balance. These defects cause much the same trouble as refractive errors. That is, they cause undue strain and hence may ultimately produce temporary disability of the eyes as the result of prolonged fatigue of the eyes and the body. It would be well to put candidates for signal work through a careful examination for these errors, and, if they are present, put the candidate himself on probation or in extreme cases reject him altogether for signal work.

Of errors of this sort it may be remarked, first, that confusion due to them is revealed by the fact that it disappears if one eye is shut; second, that troubles of this sort may be accentuated or converted from latent into positive sources of mischief by some of the conditions of naval service, *e. g.*, by the too prolonged use of a spy-glass which excludes one eye from vision.

5. *Slow Reaction Time.*—In the complex process of seeing, interpreting what is seen, and expressing or acting on the interpretation, a certain time is consumed, which differs in different people. In certain avocations it is important that this time be reduced to a minimum. For a railway engineer, a motor driver, a pilot, a gun-pointer, or a signalman this need is imperative. This is well recognized in the navy, where a man, no matter how keen-sighted, how intelligent, or how steady, is rejected for gun-pointing or for signalling, if on trial he is found to be persistently too slow. A man must be sharp in all his reactions, "quick on the trigger," as they say. Such men fortunately are fairly numerous in our navy, containing as it does bright, active, and wholesome youngsters, abounding in physical energy and spirit. Even among these, however, there may be some who do not react quickly enough to be good signalmen. Would it not be well to weed these men out by psychological tests of their reaction time, taken when they are first detached for signal work, rather than, as at present, to find out by weeks of useless trial that they are too slow?

6. *Slow Adaptation.*—A signalman's work on shipboard requires quick adaptation. With varying sunlight, the glare from water and bright work, lights below decks of varying intensities, signal lights, ship's light, and searchlights, he is often required to change suddenly from one condition of illumination to another. This change requires quick retinal adaptation, as otherwise there may be confusion in seeing with a retina ill-adapted to the existing illumination.

It also causes visual discomfort which may after a time result in visual disability. The causes of this discomfort, as Feree has pointed out, are sudden dilatations and contractions of the iris, conjunctival irritation, and fatigue of the exterior eye muscles.

The effect of slow or imperfect adaptation on signalling efficiency has not, so far as I know, been examined scientifically. It would seem as if this were a promising field for the physiologists, psychologists, and our naval medical men.

7. Effect of After-Images.—After-images conceivably may be a cause of confusion in signals by night semaphore, by winker light, and by flashlight—and possibly by Ardois. That they have this effect is doubtful, but the case requires study.

8. Effects of Ocular and General Fatigue.—It is obvious that to do signal work as it should be done, the signalman must be continuously alert and mentally and physically quick. He must not only be all the time in a state of physical efficiency, but must have a good store of surplus energy so as no time to be close to the limit of his resources. Usually this desirable state obtains, for in the first place our seamen are picked men—physically fit and mentally alert. In the second place, life on board ship is stimulating and wholesome to mind and body, and tends to keep men constantly in good condition.

One serious drawback is to be noted. Reference has been made more than once to the fact that our navy is undermanned. The result is that even in the ordinary routine work the men have to work overtime, and when doing high pressure work, as in performing evolutions or target practice, they may have to work almost continuously for many hours at a time. No body of men, however fit, can keep up continuously under such a strain. Efficiency in all directions is impaired, and, not least, efficiency in signalling.

Conclusions.

From these desultory observations the following conclusions may be drawn.

1. The standards of vision and color vision now required in the navy should by no means be diminished, but rigorously maintained. It would be well if equally high and rigid standards could be applied to the army. And it becomes us as laymen to uphold in every

way the efforts of the medical men of the navy to maintain these usual standards, which too often are assailed by politicians and well-meaning friends of candidates who, we may believe, are ignorant of the danger to which they would expose our ships.

2. A man detailed for signal work in the navy should be examined for slight errors of refraction and for muscular anomalies. If these are present, he should be tested from time to time to see what effect these errors are having on his signal capacity, and if they are impairing it he should be relegated to other duty.

It would be well to collect a considerable mass of data on this point, so as to determine once for all the effect that by and large these errors of refraction do produce on signalling ability and other tasks—gun-pointing and lookout work—which require a high degree of sustained visual power.

3. It would be well if psychological tests of the reaction time could be made to determine the fitness of men for signal work, and, particularly when the tests indicated sluggishness, to repeat them later from time to time as checks on the signalling efficiency.

From these experiments, too, a good deal of valuable data could in time be accumulated, which would, *e. g.,* show the true relation existing between reaction-time tests and signalling efficiency.

4. The present deplorable undermanning of the navy should not be permitted to continue. Putting it on no higher plane than simple business prudence and national self-interest, it is vital that the highly specialized work of our navy should be properly done; and it cannot be done when a ship, as now, carries but two thirds of its minimum complement.

In conclusion, I should like to put in a plea for the extension of signalling throughout the country. It is healthful stimulating work, that carries one into the open, that becomes fairly fascinating as one pursues it, and that may be extremely valuable in time of need. To be able to talk to a companion or stranger miles away by the motions of the wig-wag or hand semaphore (made with a handkerchief and stick), by sound signals, or by extemporized flash lantern or searchlight not only is often a great saving of time and trouble, but in many an instance will be the means of averting some supreme disaster and of saving life itself.